

## PATENT ABSTRACTS OF JAPAN

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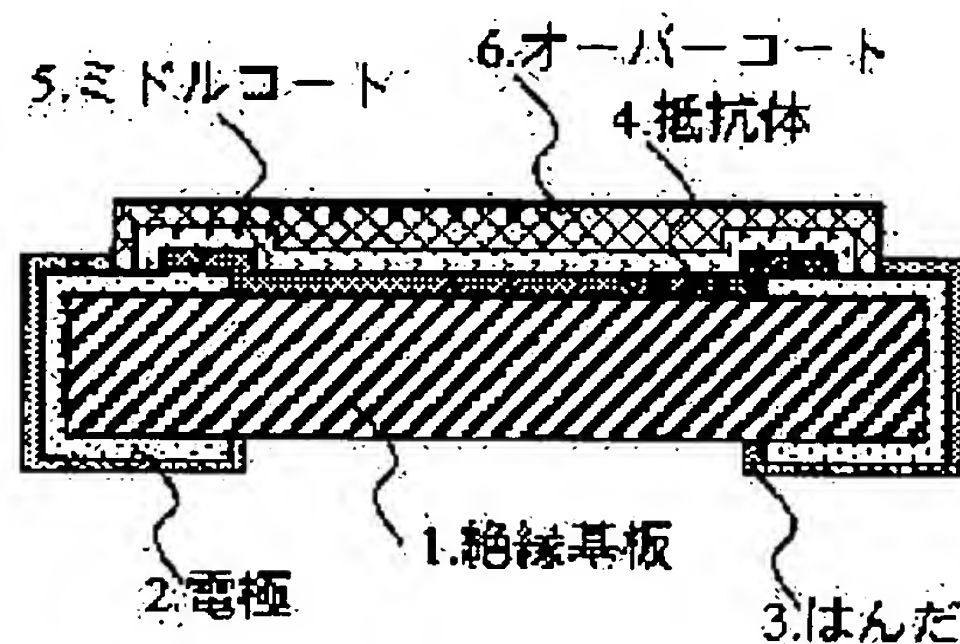
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(54) RESISTOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a resistor that only contains metallic elements which substantially exert no bad influence upon human bodies.

SOLUTION: The metallic elements contained in the resistor is selected from alkali metals, Mg, Ca, Sr, Ba, Ra, Al, Si, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Ge, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, In, Sn, Sb, Te, Hf, Ta, W, Re, Os, Ir, Pt, Au, Tl, Bi, Po, or lanthanoids.



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CLAIMS

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[Claim(s)]

[Claim 1] In an insulating substrate, a conductor, a membrane resistance object, and the film resistor that has a coating member The metallic element which the resistor concerned contains Alkali metal, Mg, calcium, Sr, Ba, Ra, aluminum, Si, Sc, Ti, V, Cr, Mn, Fe, Co, The film resistor characterized by being chosen out of nickel, Cu, Zn, Ga, germanium, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, In, Sn, Sb, Te, Hf, Ta, W, Re, Os, Ir, Pt, Au, Tl, Bi, Po, or a lanthanoids.

[Claim 2] The film resistor according to claim 1 which at least one of an insulating substrate, a conductor, a resistor, and the coating members makes glass a component, and is characterized by the glass concerned being a HOUKEI acid Ba system, a HOUKEI acid calcium system, or a HOUKEI acid Mg system.

[Claim 3] The film resistor according to claim 2 characterized by replacing with glass and considering as a resin system ingredient.

[Claim 4] In the ceramic resistor which has a conductor and the resistor which consists of a ceramic The metallic element which the ingredient which constitutes the resistor concerned contains Alkali metal, Mg, calcium, Sr, Ba, Ra, aluminum, Si, Sc, Ti, V, Cr, Mn, Fe, Co, nickel, Cu, Zn, Ga, germanium, Y, Zr, Nb, Mo, The ceramic resistor characterized by being chosen out of Tc, Ru, Rh, Pd, Ag, In, Sn, Sb, Te, Hf, Ta, W, Re, Os, Ir, Pt, Au, Tl, Bi, Po, or a lanthanoids.

[Claim 5] The ceramic resistor according to claim 4 characterized by a ceramic making Mg and Si indispensable.

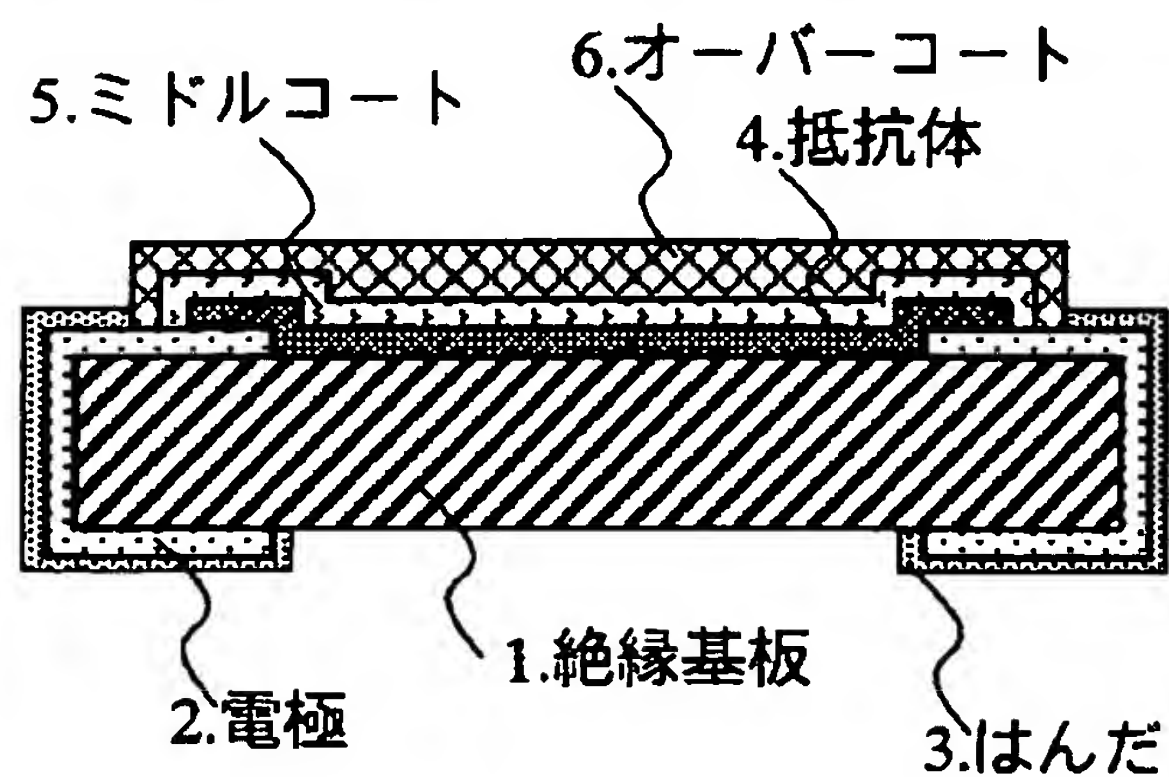
[Claim 6] The metallic element which the ingredient which constitutes the resistor concerned contains in the metal plate resistor which has a conductor and the resistor which consists of a metal plate Alkali metal, Mg, calcium, Sr, Ba, Ra, aluminum, Si, Sc, Ti, V, Cr, Mn, Fe, Co, nickel, Cu, Zn, Ga, germanium, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, In, Sn, Sb, Te, Hf, Ta, W, Re, Os, Ir, Pt, Au, Tl, Bi, Po, or the metal plate resistor characterized by being chosen out of a lanthanoids.

[Claim 7] The metal plate resistor according to claim 6 by which the resistor which consists of a metal plate is characterized by consisting of a nickel-Cr system alloy, a Cu-nickel system alloy, a Cu-Mn-germanium system alloy, a Cu-Mn-Sn system alloy, or a Mn-nickel-Cu system alloy.

[Claim 8] The resistor according to claim 1 to 7 by which a conductor is characterized by choosing the solder concerned from Sn simple substance, a Sn-Bi system alloy, a Sn-In-Ag system alloy, a Sn-Bi-Zn system alloy, a Sn-Zn system alloy, a Sn-Ag-Bi system alloy, a Sn-Bi-Ag-Cu system alloy, a Sn-Ag-Cu system alloy, a Sn-Ag-In system alloy, a Sn-Ag-Cu-Sb system alloy, a Sn-Ag system alloy, a Sn-Cu system alloy, and a Sn-Sb system alloy including solder.

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[Translation done.]

Drawing selection **Representative drawing** 

[Translation done.]

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to resistors, such as a film resistor, a ceramic resistor, and a metal plate resistor.

[0002]

[Description of the Prior Art] In recent years, the interest about reduction of an environmental pollutant discharge is increasing. The electronic parts represented by the resistor also have the demand, and the alternative to the solder which does not contain Pb is progressing about the solder which contained Pb conventionally.

[0003] Probably because Pb is an amphoteric element, it forms various compounds easily. When the body takes in the compound concerned exceeding a constant rate, deposition is carried out to an osseous tissue, it separates in blood further, and toxicity is expressed. Since it appears as the so-called symptom of lead poisoning, it considers as harmful matter.

[0004] It is understood as reduction of Pb(s) progressing especially about solder among the members which constitute electronic parts, because solder contains Pb as a metal. It is because there is a possibility of diffusing Pb compound existence area by being discarded, acid rain etc. corroding the metal lead concerned if Metal Pb exists in the electronic equipment left to the outdoors (dissolution), and permeating in the earth.

[0005]

[Problem(s) to be Solved by the Invention] As mentioned above, while reduction of the metals Pb in solder progresses, the reduction is not advancing about the HOUKEI acid Pb glass used for the coating member which constitutes electronic parts. This has comparatively chemically stable Pb which exists in the state of a compound from the beginning, and is understood because it is thought that it is hard to diffuse the existence area as compared with Pb of a metal condition. Moreover, the Pb content is understood to originate also in few things as compared with solder.

[0006] However, like HOUKEI acid Pb glass, even if it is Pb which exists in the state of a compound from the beginning, there is not no probability of diffusing Pb compound existence area in the condition of having been left to the outdoors. It continues at a long period of time, and it is thought a result, such as being put to storm sewage etc., that said diffusion advances certainly.

[0007] Then, the technical problem which this invention tends to solve is offering the electronic parts only containing the metallic element which does not have a bad influence to the body substantially.

[0008]

[Means for Solving the Problem] The resistor of this invention for solving the above-mentioned technical problem The metallic element which the resistor concerned contains Alkali metal, Mg, calcium, Sr, Ba, Ra, aluminum, Si, Sc, Ti, V, Cr, Mn, Fe, Co, It is characterized by being chosen out of nickel, Cu, Zn, Ga, germanium, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, In, Sn, Sb, Te, Hf, Ta, W, Re, Os, Ir, Pt, Au, Tl, Bi, Po, or a lanthanoids.

[0009] Although the element it may be presupposed that there is nothing under the category of a metallic element strictly like Si is contained in the element which carried out [ above-mentioned ] listing, distinguishing them strictly is easing and enumerating the strict nature of the distinction concerned from the reasons of a difficult thing etc.

[0010] Moreover, Be, Pb, Se, As, Cd, Hg, and actinoid one are not contained in the above-mentioned metallic element. The reason Be is not contained is because there is a possibility of causing a lung failure, when the beryllia which is the oxide is taken in from a breather. The reason Pb is not contained is as above-mentioned. The reason Se and As are not contained is because there is a possibility of doing a fatal failure to the organ in which these both cause toxic symptoms to and make the nucleus of the life activity of human beings, such as the circulatory system, as the worst situation by absorption from human being's breather, a digestive organ, and the skin. The reason Cd is not contained is because there is a possibility that it may permute by calcium which constitutes a bone and a bone may become weak, when Cd is taken in in the body. The reason Hg is not contained is for causing the so-called Hg poisoning, when Hg is taken in by the body. Moreover, the reason actinoid one is not contained is that actinoid one is the so-called radioactive element needless to say.

[0011] These [ Be, Pb, Se, As, Cd, and Hg ] and actinoid one are the metals with which the metal simple substance or the metallic compounds easily obtained by touching with atmospheric air, soil, seawater, and storm sewage, without passing through a special chemical reaction can serve as matter harmful to the body. Moreover, the intake any metals or metallic compounds of whose also exceed a constant rate has a bad influence on the body. Even if the amount of the points Be, Pb, Se,



As, Cd, and Hg and actinoid one, or these compounds is comparatively little, the bad influence to the body is a large metallic element.

[0012] In consideration of such a thing, the metallic element which a resistor contains Alkali metal, Mg, calcium, Sr, Ba, Ra, aluminum, Si, Sc, Ti, V, Cr, It limited to the element chosen from Mn, Fe, Co, nickel, Cu, Zn, Ga, germanium, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, In, Sn, Sb, Te, Hf, Ta, W, Re, Os, Ir, Pt, Au, Tl, Bi, Po, or a lanthanoids. However, if the existence is extent which can disregard the effect on the body with the ultralow volume which is impurity extent even if it is Be, Pb, Se, As, Cd, Hg and an actinoid simple substance, or its compound, it shall approve.

[0013] For example, it sets to the film resistor which has the middle coat 5 and overcoat 6 which coat the insulating substrate 1 as shown in drawing 1, the electrode 2 as a conductor and solder 3, a resistor 4, and the resistor 4 as a coating member. The metallic element which these resistor configuration members contain Alkali metal, Mg, calcium, Sr, Ba, Ra, aluminum, Si, Sc, Ti, V, Cr, Mn, It shall be chosen out of Fe, Co, nickel, Cu, Zn, Ga, germanium, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, In, Sn, Sb, Te, Hf, Ta, W, Re, Os, Ir, Pt, Au, Tl, Bi, Po, or a lanthanoids. The film resistor which contains only the metallic element which does not have a bad influence to the body substantially by such configuration can be offered.

[0014] The ceramic ingredient which uses an alumina, aluminum nitride, and silicon carbide as a principal component, the plate which coated the metal plate front face with the glass which does not contain poisonous metal, such as Pb, the epoxy resin Plastic solid in which the glass fiber which does not contain poisonous metal, such as Pb, was made to mix can be used for the insulating substrate 1 shown in drawing 1. The film resistor of this invention if grinding processing etc. is carried out on the occasion of abandonment of the electronic parts using that there is a possibility of dealing with beryllia as fine particles or a steam in the forming process to the substrate to it, about beryllia, and a beryllia substrate, since the fine particles of beryllia may be generated is excepted from the metallic element to constitute.

[0015] Moreover, what calcinated the metal glaze which pasted for example, Ag-Pd system alloy powder by the glass frit, and the thing to which heat curing of the electroconductive glue which made Ag powder mix in resin pastes, such as an epoxy system or acrylic, was carried out can be used for the electrode 2 shown in drawing 1. The low melting glass of a HOUKEI acid calcium system, a HOUKEI acid Ba system, or a HOUKEI acid Mg system can use it for the glass frit used for the former metal glaze here suitably. HOUKEI acid Pb glass is not contained in the glass frit concerned to it. It is because Pb is included.

[0016] Moreover, it is chosen out of for example, Sn simple substance, a Sn-Bi system alloy, a Sn-In-Ag system alloy, a Sn-Bi-Zn system alloy, a Sn-Zn system alloy, a Sn-Ag-Bi system alloy, a Sn-Bi-Ag-Cu system alloy, a Sn-Ag-Cu system alloy, a Sn-Ag-In system alloy, a Sn-Ag-Cu-Sb system alloy, a Sn-Ag system alloy, a Sn-Cu system alloy, and a Sn-Sb system alloy as the solder 3 shown in drawing 1. A Pb-Sn system alloy is not contained to it. It is because Pb is included.

[0017] Moreover, what calcinated the metal glaze which pasted for example, oxidation Ru powder by the glass frit can be used for the resistor 4 shown in drawing 1. In this case, the low melting glass of a HOUKEI acid calcium system, a HOUKEI acid Ba system, and a HOUKEI acid Mg system can be suitably used for the glass frit used for metal glaze. HOUKEI acid Pb glass is not contained in the glass frit concerned to it. It is because Pb is included.

[0018] Moreover, what calcinated the glass paste which consists of low melting glass of for example, a HOUKEI acid calcium system, a HOUKEI acid Ba system, and a HOUKEI acid Mg system, and the thing to which heat curing of the resin pastes, such as an epoxy system, was carried out can be used for the middle coat 5 and overcoat 6 as a coating material which are shown in drawing 1. HOUKEI acid Pb glass is not contained in said glass frit to it. It is because Pb is included.

[0019] Moreover, it sets to the ceramic resistor which has the resistor 4 which consists of the electrode 2, the metal cap 7, the solder 3, and ceramic as a conductor as shown, for example in drawing 2. The metallic element which these resistor configuration members contain Alkali metal, Mg, calcium, Sr, Ba, Ra, aluminum, Si, Sc, Ti, V, Cr, Mn, Suppose that it is chosen out of Fe, Co, nickel, Cu, Zn, Ga, germanium, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, In, Sn, Sb, Te, Hf, Ta, W, Re, Os, Ir, Pt, Au, Tl, Bi, Po, or a lanthanoids. The ceramic resistor which contains only the metallic element which does not have a bad influence to the body substantially by such configuration can be offered.

[0020] The ceramic which consists of the compound and/or conjugated compound which use as a principal component at least one sort of elements chosen from at least one sort chosen from calcium, Zn, Sr, and Ba with Mg and Si, at least one sort chosen from Sn, aluminum, Sb, Ga, Cr, Mn, and germanium, and Bi, Nb, Ta, V, W and Mo is used for the resistor 4 shown in drawing 2. Although Cd can also be included in the metallic element which constitutes the ceramic concerned and it does not have a bad influence on the property of a resistor 4 at all by that, since Cd is a poisonous metal element, it has been excepted from this invention as mentioned above.

[0021] When an example is shown, as a start raw material group Furthermore, MgO, SiO<sub>2</sub>, and mixture of the conjugated compound of Mg and Si, The ceramic which mixed CaCO<sub>3</sub>, BaCO<sub>3</sub> and Sn<sub>2</sub>O<sub>3</sub>, and Sb<sub>2</sub>O<sub>3</sub> with the predetermined compounding ratio, calcinated, and was obtained, or the mixture of the conjugated compound of MgO, SiO<sub>2</sub>, Mg, and Si, The ceramic calcinated [ was mixed and ] and obtained with the predetermined compounding ratio can use suitably CaO, BaO, SnO<sub>2</sub> and Sb<sub>2</sub>O<sub>3</sub>, and Bi<sub>2</sub>O<sub>3</sub> as a resistor 4. The ceramic which contains PbCO<sub>3</sub> and PbO as a start raw material group here is not contained. It is because Pb is included.

[0022] This kind of ceramic resistor, especially the ceramic resistor with which resistor 4 ingredient consists of a ceramic which uses Mg and Si as a principal component are durable to a high-pressure pulse or a large power surge, and it has the advantage which is not in other resistors from main components being ceramics -- it can be equal to the use in an elevated temperature.

[0023] Moreover, what calcinated the metal glaze which pasted for example, Ag-Pd system alloy powder by the glass frit,

and the thing to which heat curing of the electroconductive glue which made Ag powder mix in resin pastes, such as an epoxy system or acrylic, was carried out can be used for the electrode 2 shown in drawing 2. The low melting glass of a HOUKEI acid calcium system, a HOUKEI acid Ba system, and a HOUKEI acid Mg system can use it for the glass frit used for the former metal glaze here suitably. HOUKEI acid Pb glass is not contained in the glass frit concerned to it. It is because Pb is included.

[0024] Moreover, the metal cap 7 shown in drawing 2 fabricates for example, nickel plate in the shape of Kapp, and performs solder 3 plating to the front face (both sides) by the barrel plating method etc. Here, it is chosen as solder 3 out of for example, Sn simple substance, a Sn-Bi system alloy, a Sn-In-Ag system alloy, a Sn-Bi-Zn system alloy, a Sn-Zn system alloy, a Sn-Ag-Bi system alloy, a Sn-Bi-Ag-Cu system alloy, a Sn-Ag-Cu system alloy, a Sn-Ag-In system alloy, a Sn-Ag-Cu-Sb system alloy, a Sn-Ag system alloy, a Sn-Cu system alloy, and a Sn-Sb system alloy. A Pb-Sn system alloy is not contained to it. It is because Pb is included.

[0025] Moreover, it sets to the electrode 2 as a conductor as shown, for example in drawing 3 and solder 3, and the metal plate resistor that has the resistor 4 which consists of a metal plate. The metallic element which this resistor configuration member contains Alkali metal, Mg, calcium, Sr, Ba, Ra, aluminum, Si, Sc, Ti, V, Cr, Mn, Fe, Suppose that it is chosen out of Co, nickel, Cu, Zn, Ga, germanium, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, In, Sn, Sb, Te, Hf, Ta, W, Re, Os, Ir, Pt, Au, Tl, Bi, Po, or a lanthanoids. Although the resistor 4 and electrode 2 which are shown in drawing 3 here consist of a metal plate of one, they can also use a resistor 4 and an electrode 2 as another member. The metal plate resistor which contains only the metallic element which does not have a bad influence to the body substantially by such configuration can be offered.

[0026] For example, a nickel-Cr system alloy, a Cu-nickel system alloy, a Cu-Mn-germanium system alloy, a Cu-Mn-Sn system alloy, or a Mn-nickel-Cu system alloy can use suitably the metal plate which constitutes the resistor 4 and electrode 2 which are shown in drawing 3.

[0027] Moreover, it is chosen out of for example, Sn simple substance, a Sn-Bi system alloy, a Sn-In-Ag system alloy, a Sn-Bi-Zn system alloy, a Sn-Zn system alloy, a Sn-Ag-Bi system alloy, a Sn-Bi-Ag-Cu system alloy, a Sn-Ag-Cu system alloy, a Sn-Ag-In system alloy, a Sn-Ag-Cu-Sb system alloy, a Sn-Ag system alloy, a Sn-Cu system alloy, and a Sn-Sb system alloy as the solder 3 shown in drawing 3. A Pb-Sn system alloy is not contained to these. It is because Pb is included.

[0028] Moreover, as mold material 8 shown in drawing 3, a liquid crystal polymer, PPS (polyphenylene SURUFAIDO) and phenol system resin, epoxy system resin, etc. can use it suitably.

[0029]

[Embodiment of the Invention] The chip resistor according the gestalt of the operation about the film resistor shown in drawing 1 of this invention to a film formation technique is explained to an example below. Each chip resistor dimension is made into one unit, and they screen-stencil and calcinate the conductive paste which consists of Ag-Pd system metal glaze on insulating-substrate 1 large-sized top face and large-sized inferior surface of tongue made from an alumina which are divided into the slot for division in all directions, and exist, and form an electrode 5 in them. The paste which consists of oxidation Ru system resistor metal glaze as a resistor 4 after that is screen-stenciled so that the both sides of the electrode 2 of the pair on insulating-substrate 1 top face may be contacted, and it is calcinated, and a resistor 7 is formed. Subsequently, a glass paste is screen-stenciled and calcinated and the middle coat 5 is formed so that the resistor 4 whole may be covered. After that, for resistance adjustment, the trimming slot by laser radiation is formed so that it may become target resistance. And overcoat 6 paste of an epoxy resin system is screen-stenciled, and heat hardening of the paste concerned is carried out so that a resistor 4 and the middle coat 5 may be covered at least and the electrode 2 of insulating-substrate 1 top face may be slightly exposed. Here, said metal glaze and the glass component contained in a glass paste are the HOUKEI acids calcium. Moreover, during the overcoat paste, the metallic element is not contained substantially.

[0030] Next, stress is applied so that the slot for the above-mentioned division may be opened, the insulating substrate 1 along the division slot concerned is divided, and it considers as each chip resistor unit. And acrylic resin system Ag electrode paste is applied to insulating-substrate 1 end face (field exposed for the first time by said division) with a roller replica method, heat curing of it is carried out, and it carries out to some electrodes 2 so that it may be made to flow through the electrode 2 of insulating-substrate 1 top face and an inferior surface of tongue. Nickel plating (not shown) and solder 3 plating are performed to this order on electrode 2 front face exposed after that, and the chip resistor of this invention is obtained. The solder 3 here was used as Sn simple substance. Moreover, the metallic element which acrylic resin system Ag electrode paste contains is only Ag substantially.

[0031] The metallic elements which the film resistor of the shape of a chip acquired here contains are aluminum, Ag, Pd, Si, calcium, Ru, nickel, and Sn. Namely, the metallic element which the chip resistor obtained here contains Alkali metal, Mg, calcium, Sr, Ba, Ra, aluminum, Si, Sc, It is chosen out of Ti, V, Cr, Mn, Fe, Co, nickel, Cu, Zn, Ga, germanium, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, In, Sn, Sb, Te, Hf, Ta, W, Re, Os, Ir, Pt, Au, Tl, Bi, Po, or a lanthanoids.

[0032] The gestalt of the operation about the ceramic resistor shown in drawing 2 of this invention is explained below. The start raw material of a resistor 4 is first set to the mixture (i) of the conjugated compound of MgO, SiO<sub>2</sub>, and Mg and Si, and CaCO<sub>3</sub> (ii), BaCO<sub>3</sub> (iii) and Sn<sub>2</sub>O<sub>3</sub>, (iv) and Sb<sub>2</sub>O<sub>3</sub> (v). These weight-mix ratios are set to (i):(ii):(iii):(iv):(v) = 14:78:1:2:4, \*\*\*\*\* of these start raw material is made into the 100 weight sections, CMC (carboxymethyl cellulose) and water, and ethylene glycol are put into it, 1 weight section, 21 weight sections, 2 weight \*\*\*\*\* and these start raw material group are put into a mixed container, respectively, it decompresses after stirring and degassing is carried out.

[0033] The paste start raw material of the above after mixed process termination is fabricated in the shape of [ fixed ] a cylindrical shape, and baking in atmospheric air of a total of 16 hours maintained at a maximum of 1380 degrees C after air



drying for 2 hours is presented. Then, ethylene glycol, CMC, and moisture disperse completely, and become the sintered compact of metallic compounds, i.e., a ceramic. The conductive paste which consists of Ag-Pd system metal glaze mentioned above to cylindrical both ends by making this ceramic into a resistor is applied and calcinated, and an electrode 2 is obtained. nickel (electrode cap 7) fabricated in the shape of [ which made the both sides carry out plating formation of the solder (Sn simple substance) beforehand by barrel plating after that ] a cap is pressed fit in electrode 2 part, and the ceramic resistor of this invention is obtained.

[0034] The metallic elements which the ceramic resistor obtained here contains are Mg, Ba, Ag, Pd, Si, calcium, Sb, nickel, and Sn. Namely, the metallic element which the chip resistor obtained here contains Alkali metal, Mg, calcium, Sr, Ba, Ra, aluminum, Si, Sc, It is chosen out of Ti, V, Cr, Mn, Fe, Co, nickel, Cu, Zn, Ga, germanium, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, In, Sn, Sb, Te, Hf, Ta, W, Re, Os, Ir, Pt, Au, Tl, Bi, Po, or a lanthanoids.

[0035] The gestalt of the operation about the metal plate resistor shown in drawing 3 of this invention is explained below. The crosswise both ends of the part which first serves as a resistor of the alloy ribbon (metal plate) with a width of face [ of 2.4mm ] and a thickness of 150 micrometers of Cu:nickel=1:1 (weight ratio) are excised, and it is made for the width of face of the part concerned to be set to 2.0mm. And the trimming line of a single cut is formed in the part which serves as said resistor so that resistance may turn into a desired value (10mohm) by the machining method (partial grinding of the piece of a metal using a disk cutter), carrying out resistance measurement at intervals of the 10mm of the die-length directions of an alloy ribbon (all the parts that serve as said resistor in the meantime are contained.). The piece of a metal is covered with the mold material 8 so that the part used as the account resistor of back to front may serve as middle of a pre-insulation field. Said covering is based on mold shaping at the mold material 8 using a liquid crystal polymer. The piece of a metal is cut so that the piece of a metal with a die length of 2mm may be exposed on both sides after that.

[0036] Said exposed metal plate (electrode 2) is turned up to the mold material 8 side used as a resistor inferior surface of tongue, coppering with a thickness of 40-50 micrometers and solder 3 (Sn simple substance) plating with a thickness of 4-6 micrometers are performed to this order on electrode 2 front face after that, and the metal plate chip resistor for current detection concerning this invention as shown in drawing 3 is obtained. In order that plating liquid might not contact the resistor 4 of the metal plate covered with the mold material 8 at this time, the above-mentioned copper and solder were not formed.

[0037] The metallic elements which the metal plate chip resistor for current detection obtained here contains are nickel, Cr, Cu, and Sn. Namely, the metallic element which the metal plate resistor obtained here contains Alkali metal, Mg, calcium, Sr, Ba, Ra, aluminum, Si, Sc, It is chosen out of Ti, V, Cr, Mn, Fe, Co, nickel, Cu, Zn, Ga, germanium, Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, In, Sn, Sb, Te, Hf, Ta, W, Re, Os, Ir, Pt, Au, Tl, Bi, Po, or a lanthanoids.

[0038] On the occasion of manufacture of the film resistor represented with this example by drawing 1, film formation techniques, such as a screen-stencil technique, a spreading technique by roller transfer, and a plating technique, were utilized. However, the film resistor of this invention is not limited to what is depended on these film formation techniques. For example, it cannot be overemphasized that thin film technologies, such as vacuum evaporatio, sputtering, and CVD, etc. can be used.

[0039] Moreover, the coating material of the film resistor represented with this example by drawing 1 is used as the middle coat 5 and overcoat 6 which are obtained by screen-stencil. However, it cannot be overemphasized that the gestalt which forms the film-like resistor 4 on the 1st page of the insulating substrate shown in drawing 1 R> 1, connects a lead terminal to an electrode 2 with means, such as welding, carries out the mold of the whole film resistor by resin etc. so that the outside edge of the lead terminal concerned may be exposed, and uses the resin concerned as a coating material is employable.

[0040] Moreover, it cannot be overemphasized that the resistor which has two or more resistance elements, such as so-called multiple-string chip resistor, so-called chip network resistor, etc., is contained in the resistor of this invention, especially a film resistor.

[0041] Moreover, it may be desirable to replace with the glass (glass paste used as metal glaze and a coating material) used by this example, and to make these all into a resin system ingredient. It is because a resin system ingredient cannot contain a poisonous metal element like Pb easily. Moreover, since the burning temperature of metal glaze or a glass paste is as high as about 400-800 degrees C, they require big energy on the occasion of manufacture of a resistor. Since the point resin system ingredient is hardened at about 200 degrees C, it has the advantage which the degree of freedom of the ingredient selection which constitutes a manufacturing facility increases. Moreover, when the maximum temperature which a resistor receives in a production process in this way falls, there is an advantage to which the degree of freedom of the ingredient selection of those other than said resin system ingredient (for example, insulating substrate 1) also becomes large. Therefore, an insulating substrate 1 can also be used as a resin system ingredient. Since it is the same, the lower one at about 130-180 degrees C of the melting point of the solder 3 which does not contain harmful matter, such as Pb, is desirable. The reason for having made the minimum of the melting point concerned into 130 degrees C is because maintenance of the height of the degree of freedom of the alloy presentation which constitutes solder 3 was taken into consideration.

[0042]

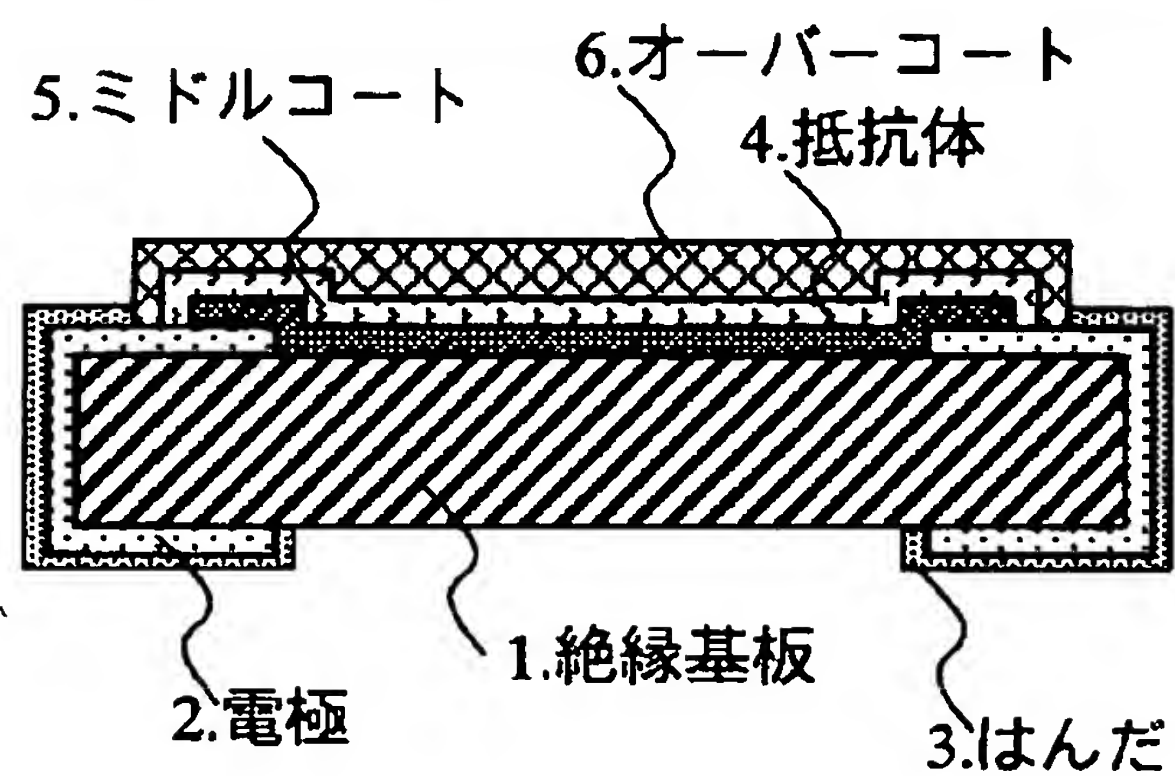
[Effect of the Invention] The electronic parts which contain only the metallic element which does not have a bad influence to the body substantially by this invention were able to be offered.

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[Translation done.]



Drawing selection **Representative drawing** 



[Translation done.]